south carolina

Fish Pond

management guide

South Carolina Department
of Natural Resources

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FISH POND MANAGEMENT GUIDE

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This booklet is provided as a general guide to assist individuals with the management of their ponds. Additional technical assistance can be obtained by contacting your nearest district fishery biologist (page 25).

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FISHING

Fishing is the most popular form of participation sport in South Carolina, and interest is still on the rise. Surveys show that in South Carolina freshwater fishermen contributed nearly $500 million annually to the State's economy. This indicates that fishermen will spend considerable time and money to enjoy the sport. Properly managed fish ponds can provide excellent fishing near home at a reasonable cost.

But good fishing in ponds seldom just happens — it takes careful planning and management. This publication provides South Carolina pond owners with guidance in pond management that will produce high quality fishing year after year.

pond construction

A prudent person would not begin to build a house or barn without first designing and planning a structure that suited his needs. A prospective pond owner should likewise plan for a pond that is located suitably, designed and built properly, and will satisfy his fishing requirements. The National Resources Conservation Service provides excellent assistance on pond design and construction. Their representatives will provide cost estimates, custom design surveys, soil analyses, and advice on other aspects of pond construction. It is strongly recommended that prospective pond owners avail themselves of these services.

pond preparation

Competition from "wild" fish species is one of the major causes of poor fishing in South Carolina ponds. Therefore, the first step in stocking a pond after construction is to eliminate all existing fish. If the pond is fed by a stream, the fish in that stream must also be eliminated.

Rotenone is used to kill fish without harming other animals (it affects only creatures having gills). Rotenone can be found at most farm supply outlets as a 5% powder, sometimes called cubé. A liquid formulation is also available at about the same price per unit of active ingredient, but may be difficult to obtain.

NOTE: Rotenone is a restricted-use pesticide, which means that a category 5, S.C. certified applicator license is required for its purchase and/or use in South Carolina. Unfortunately there are no feasible alternatives to rotenone available at present. Therefore, it is necessary to obtain the assistance of a certified applicator. Your district fishery biologist can provide further details. AS WITH ALL PESTICIDES, READ AND FOLLOW ALL LABEL INSTRUCTIONS.

For ponds, rotenone should be applied at the rate of 6 lbs. of 5% powder per acre-foot of water. An acre-foot is an acre of water one foot deep. To obtain the number of acre-feet in your pond, multiply the number of surface acres by the average depth in feet. Be sure to take into account shallow edges as well as deep holes in calculating average depth. It is better not to estimate the area and depths, but rather to actually measure them. Since the powder does not dissolve well in water, it should first be worked into a paste with a small amount of water. Gradually add more water until a thin slurry is obtained. Pour the slurry into the prop wash of a boat as the entire surface of the pond is traversed, using more in deeper areas. Be sure to apply toxicant to all potholes and standing water within the pond site, regardless of size. Some fish can survive for extended periods in nothing more than a deep footprint that contains water.

If you are using 5% liquid rotenone, use ˚ gallon per acre-foot. Dilute it enough to treat the entire pond easily, and apply it as the powder.

Small streams entering the pond should also be treated with rotenone. Use 10 lbs. of 5% powder or 3 quarts of 5% liquid per 1/4 mile of stream averaging 10 feet wide and one foot or less in depth. If the stream is short (less than ˚ mile), the job is best done by applying the toxicant at the source over a period of about an hour, and letting the current carry it the length of the stream. If the stream is longer, begin at the source and also apply at several intervals downstream. Be sure to treat all adjacent potholes and tributaries of the stream. A second treatment the following day is usually required for total fish removal in streams. **There are a number of complications involved in the application of toxicants in streams, including questions of legal liability and environmental responsibility. Before you renovate a stream. Please contact the district fishery**

biologist for guidance. Rotenone should be applied in the first half of September, so that there will be less chance of wild fish infestation prior to bluegill stocking, which occurs in November or December. The rotenone will detoxify in 6 to 30 days, depending on water temperature.

When renovating a pond, always lower the water level as much as possible first. By doing this, less rotenone will be required and a more efficient kill will occur. All drain outlets in the pond must be closed during renovation and until the rotenone is completely neutralized. Rotenone that escapes downstream is toxic and YOU ARE RESPONSIBLE FOR DOWNSTREAM EFFECTS!

After applying rotenone, fish should begin to surface within about 5 minutes. A large percentage of the fish will surface only once then will sink to the bottom and rise the next day or the day after as they begin to decompose. The dead fish may be removed from the pond and disposed of in any acceptable manner, but if they are left in the water, no harm will be done except for appearance and temporary unpleasant odors. Turtles, birds, and other scavengers will remove many of the carcasses.

stocking fish

After renovating your pond, fingerling bass and bream for stocking may be obtained from the South Carolina Department of Natural Resources. An application for fish can be obtained from your district fishery biologist and must be mailed to Columbia (the address is on the application) prior to October 15 of the year you want the pond stocked. A user fee is charged, and a check or money order for the proper amount must accompany the application. The minimum size pond that will be stocked is 1/4 acre. Fish are also available from commercial dealers, including some species that the SCDNR does not stock in private ponds, such as channel catfish. A listing of licensed dealers can be obtained from your district fishery biologist.

The bream (from the SCDNR) are normally delivered in November or December and the bass are stocked the following spring. It is important to decide before you order fish whether or not you plan to fertilize, so that stocking can be done at the proper rate. Fertilized ponds are stocked at the rate of 1,000 bream (bluegill to shellcracker at 3:1 ratio) and 100 largemouth bass per acre, and unfertilized ponds at one half

that rate. At this time, the SCDNR offers no other species of fish for pond stocking. DO NOT OVERSTOCK YOUR POND, PLEASE!! Overstocking can be a major cause of population imbalance and will probably cause you to be dissatisfied with the fishing it produces. If you wish to stock species other than those recommended by the SCDNR, it is advisable to consult first with the district fishery biologist. There are some pitfalls associated with other species that are not always evident to pond managers. For example, the use of shiners or minnows in ponds as bait or forage is discouraged because their escape could provide a rapidly expanding source of competition for existing fish populations. Some shiner species, such as golden shiners, can be especially damaging if they reproduce in your pond.

fertilization

There are a number of advantages to pond fertilization. It will allow increased fish production, better aquatic weed control, and better overall fishing. In South Carolina where many ponds are lightly fished, the main advantage to fertilization is weed control.

Fish ponds in South Carolina are often built over relatively infertile, acid soils, or receive water from swampy watersheds. As a result, most pond waters (except those near the coast) have a low hardness, alkalinity, and pH. This condition necessitates the use of lime before fertilization will be effective. Agricultural lime should be used, never quicklime or slaked lime. It should be applied at rates varying from one to four tons per acre, depending on alkalinity. The SCDNR will perform a water chemistry analysis on request at no charge.

Lime is best applied by broadcasting it over the bottom of an empty pond and disking it in. Remember, you are liming the soil, not the water. If the pond is full of water, the lime must then be scattered over the entire pond surface. Bulk lime is cheaper than the bagged variety (varies around $30 per ton, delivered), and in some cases where small ponds are involved, your farm supply dealer may have the equipment to spread the lime for you. However, since this is frequently not practical, a liming platform may be rigged using two boats and a plywood platform (See Figure 1).

Lime should be applied during the fall or early winter so that it will have time to react with bottom muds before fertilizer is applied in the spring. In ponds with normal rates of water loss, liming will last about 3 years. Once a pond has been limed, small annual applications (25% of the initial rate) may be used to avoid having to apply in bulk every few years.

In general, there are three fertilizer formulations that may be used effectively in South Carolina. Granular fish pond fertilizer (20-20-5 formulation) is the most widely used and has been found to be effective in producing moderate to heavy blooms in most ponds. It is only moderately expensive ($7-$9/40 lb.), and a fertilizer platform is recommended for application. Liquid ammonium polyphosphate (10-34-0 or a similar formulation) is rapidly gaining popularity among pond managers and recent evaluations are promising. It is comparable to granular formulations in price ($4-$6 gal), but is

LIME *application*

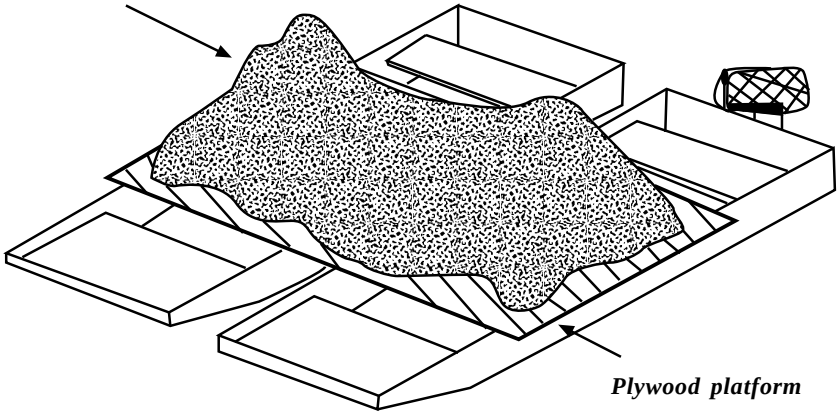

Figure 1 - A simple way of applying lime to a pond that is full of water.

FERTILIZER *platform*

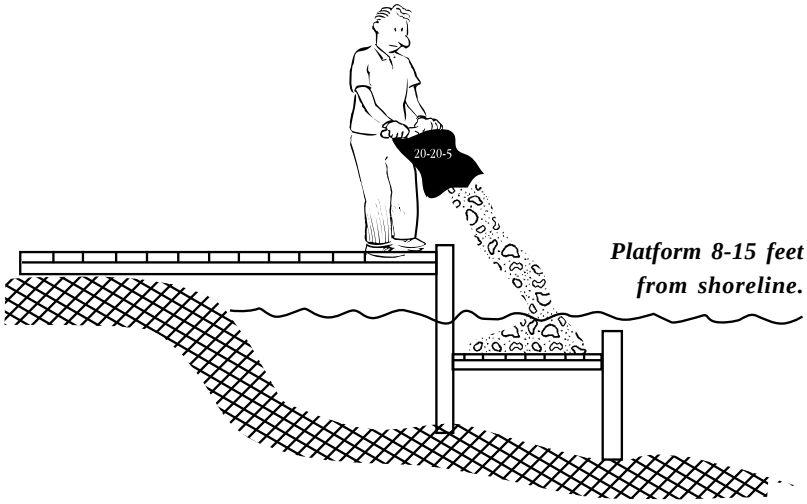

Figure 2 - The use of a fertilizer platform is the best way to apply granular fertilizer.

slightly more efficient in use. It is also fairly easy to apply.

Some ponds may require only super or triple superphosphate to produce a good bloom. Since it is usually applied in smaller amounts, it is cheaper (varies around $7.50/bag) than the 20-20-5. It is applied in the same manner as other granular types.

Organic fertilizers (manure, cottonseed meal, etc.) are not recommended for use in South Carolina ponds. They are low in nutrients and huge quantities are needed to produce the same bloom as small amounts of chemical fertilizers. They can easily cause oxygen depletions if not used very carefully. In addition, there may be a link between the use of organic fertilizers and increased fish disease.

Granular fertilizers may be applied several ways. The most efficient way is to use an underwater platform similar to the one shown in Figure 2. It need not be elaborate, and the design is limited only by individual imagination.

The platform should be about 5' X 5' square and 1'-2' below the surface of the water. One platform is sufficient for 4-8 acres of pond. This method will keep fertilizer nutrients from being tied up and wasted by bottom muds and can reduce fertilizer costs by 25%. Simply pour the fertilizer on the platform and water currents will distribute the nutrients as they dissolve.

A second less effective way is to slit the fertilizer bag widely on one side and place in shallow (1'-2 °' deep) water with the slit side up so that the fertilizer can dissolve. This method will not disperse the nutrients as well as a platform. Broadcasting the fertilizer granules out onto the pond bottom is not recommended because much of the mineral content is wasted as it is tied up in bottom sediments.

Liquid fertilizers are best applied by mixing one part fertilizer with ten parts water and pouring the mixture out behind a boat or splattering it in the water around the pond edge. Do not pour the concentrated fertilizer directly in the water because it is heavier than water and will sink to the bottom and lose much of its effectiveness.

Fertilization programs in South Carolina should begin in March and continue through October. A sample schedule is as follows:

1. On March 1, or when the water temperature has reached 64° F, apply 40 lb. per acre of 20-20-5 or 1.5 gal. per acre of liquid polyphosphate. Follow with 2 additional applications at two-week intervals.
2. Make 3 more applications at 3-week intervals.
3. Continue applications at monthly intervals or whenever the water clears enough so that a white object can be seen 18" below the surface.
4. Discontinue applications at the end of October.

Not all ponds can be managed as the above example. More or less fertilizer may be required. Some ponds may be well served with only an occasional application of superphosphate. New ponds will usually require heavier rates than old ones. Since each pond is different, the owner must experiment until he finds the

most economical way to produce an adequate bloom. Do not overfertilize. Overfertilization produces undesirable surface scums and can contribute to low dissolved oxygen levels and subsequent fish mortality.

There are instances when a pond should not be fertilized:

1. If the water is frequently muddy, turbid, or very darkly stained with humic acids so that a white object cannot be seen at a depth of 18".
2. If the pond has a heavy growth of aquatic weeds. Those weeds will use the fertilizer intended to produce the “bloom.” The weeds will grow well and the pond will remain clear.
3. If the retention time of the water in the pond is not at least 3 weeks, then the fertilizer will be flushed out before it can do its job. Occasionally a bottom-draw design drainpipe can overcome this problem.
4. If fish in the pond receive their food primarily from artificial feeds, and weed control is not a problem, as is the case in some ornamental or culture ponds.

water quality

Good water quality is essential to successful fish production in South Carolina ponds. There are many factors involved and the relationships are complex. The major factors are presented here. Warmwater fishes grow best at temperatures between 75° F and 90° F. Since water in South Carolina drops below that in the winter, management procedures such as fertilization are halted or reduced during that time. In the summer, water temperatures frequently rise above 90° F. This reduces the amount of dissolved oxygen that can be held by water by a large percentage. It also causes the water to form layers (stratify), where a warm upper layer forms over a cooler layer. The upper layer may be from 3 to 6 feet deep, usually supports a good growth of phytoplantkton, has ample dissolved oxygen, and maintains good overall water quality. The lower, cooler layer, which frequently comprises most of the water in the pond, extends to the bottom, is low in or devoid of dissolved oxygen, supports little phytoplankton growth, and generally has poor overall water quality (See

Figure 3). Most pond fishes will not stay in this lower layer for long, and certainly will not spawn in it. Most South Carolina ponds stratisfy in the spring and remain that way until fall, although some very shallow ponds stratify in the morning and mix at night on a daily cycle.

dissolved oxygen

Dissolved oxygen (D.O.) is the most critical water quality variable in South Carolina ponds. Its main source in water is the growth activity of phytoplankton (bloom). There is some diffusion of oxygen into the water from the air, but this is negligible. Since oxygen is produced by plant growth and plant growth is dependent upon sunlight, then indirectly the amount of D.O. in a pond is related to the amount of sunlight received during the day, as well as to the amount of bloom produced.

D.O. is lost from the water in two principal ways. Fish and other aquatic animals remove a portion through their

LAYERING *ponds*

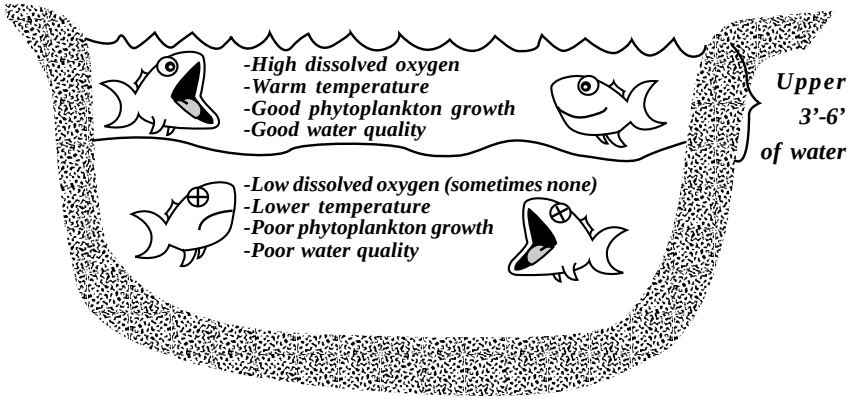

Figure 3 - Stratification (layering) of a fish pond in the summer.

respiration. Also, although phytoplankton produce oxygen during sunlit hours, they use it at night, so an appreciable amount is used by aquatic plants when the sun is not shining.

In fertilized ponds the D.O. levels might typically range from 2 ppm (parts per million) at dawn to 12 ppm in the late afternoon of a sunny day. Remember that in the summer, the pond is probably stratified, and that nearly all of the D.O. is in the upper few feet of water.

Fish require at least 3 ppm of dissolved oxygen for long-term health and good reproduction, but can tolerate as little as 0.3 ppm for short periods. They will die at concentrations below 0.3 ppm. Extended exposure to marginal D.O. conditions can cause poor growth, increased disease, and wide variety of other adverse effects.

pH

The pH is a measure of the acidity of the water. Going from 7.0 (neutral) toward zero is more acidic, and from 7.0 to 14.0 is more alkaline. The ph of pond waters is greatly influenced by the presence of carbon dioxide, and acidic substance that is removed from the water by plants during the day. Consequently, the ph rises during the day and decreases at night. In South Carolina fertilized ponds, pH may range from 5.5 at daybreak to as much as 11.0 by late afternoon. The pH is also affected to a lesser extent by hardness and alkalinity.

Fishes grow best between pH 6.5 to 9.0, which can be obtained in properly limed and fertilized ponds. At long-term values outside of this range, growth and reproduction will be reduced and death may even occur.

alkalinity and hardness

Hardness refers to the concentration of metals (mostly calcium and magnesium) in the water. Alkalinity is the total concentration of bases. The two values are related, and in most South Carolina ponds are typically very low -- below 20 ppm. For fertilizer to be effective, hardness and alkalinity must be above 20 ppm, and this can be accomplished by proper liming. Liming will also help to counteract the wide pH swings caused by low alkalinities.

fishing the pond

Do not begin to fish a newly-stocked pond until June of the year after the bass were stocked (or after the bass have spawned for the first time). At this time, the bass should weigh from ˚ to 1 lb. and the bream should be up to about 1/4 lb.

One cause of poor fishing in South Carolina ponds is the common practice of "saving" the pond by allowing only limited fishing so that the fish present will be large and numerous. This is a serious error large fish will not be produced, but rather an overabundance of small, stunted fish. The bass/bluegill combination, stocked at proper rates, depends upon adequate harvest to produce good fishing year after year. Harvest should be near the following rates:

	Bream	Bass
Fertilized ponds	100-125 lb./acre/year	25 lb/acre/year
Unfertilized ponds	40-50 lb./acre/year	10 lb/acre/year

Harvest should be spread out over the year so that no more than 25% of the total is removed in any given month. During the first fishing year after stocking, it is recommended that bass be harvested at slightly less than the above rates.

PROPER HARVESTING OF YOUR POND IS VERY IMPORTANT! Failure to do so may result in population imbalances and ultimately poor fishing.

weed control

Aquatic weeds that may grow in your pond are usually undesirable. They interfere with fishing and boating, utilize nutrients needed for phytoplankton growth, allow small bream to successfully escape bass predation, provide breeding places for mosquitoes, and can cause D.O. depletions if they die off suddenly for any reason.

The best cure for nuisance aquatic vegetation is prevention. Proper pond construction (deep edges) is the first step, with a good fertilization program following close behind. The resulting phytoplankton bloom will discourage the growth of most aquatic weeds by shading them out so that they cannot gain a foothold. However, once weeds are established, fertilization will generally not eliminate them, and will probably make matters worse. They must be controlled prior to beginning fertilization.

Winter drawdowns provide one method of partially controlling aquatic weeds, particularly in ponds with large expanses of shallow water. The technique involves lowering the water level each year from the first of December until the first of March so that the shallow weed-infested areas are exposed to freezing and drying conditions for that period. A drawdown has the added benefit of concentrating forage fish populations so that bass or other predators can "chow down" on them. This reduces stunted bream numbers and produces bigger, fatter bass. Be sure, if the pond is shallow all over, that enough water remains after drawdown to support the entire fish population, even if some weeds must remain submerged. A good rule of thumb is to leave enough water to maintain 50% of the pond's surface area. Also, be sure that the method used to remove the water does not allow fish to escape.

Hand removal of weeds is sometimes feasible, particularly in small ornamental ponds where labor is available. Weed harvesting machines are sometimes used, but are very expensive and generally ineffective. They are not recommended.

Weed control using insects is a method that has potential in South Carolina. The alligatorweed flea beetle and similar insects have had limited success in several of our river systems. It has been found, however, that they fall considerably short of the level of success desired. Research is still underway in this area.

There are a number of fishes that are capable of controlling weeds with varying degrees of efficiency. Species that can be stocked legally in South Carolina ponds are discussed below. Be aware that other species of fishes may consume vegetation, but may be illegal to import or possess in this state. If you have any doubts about a particular species of fish, contact the SCDNR for clarification prior to obtaining them.

1. Tilapia (African bream): These are essentially tropical fish that are advertised by their producers to consume a wide variety of aquatic vegetation. Unfortunately, they usually eat a lot less than advertised, but sometimes do an adequate job on certain species of algae. Winter water temperatures are fatal to these fish and they must be restocked every year. In general, pond owners feel that Tilapia do not give the desired level of control and that restocking makes them too expensive for the average pocketbook.
2. Israeli carp (mirror carp): A large, robust fish having only a few widely separated scales. These fish enjoyed a brief period of popularity and are still used by some. They are able to control light infestations of some types of algae, but have proven to be ineffective in controlling most weed infestations common to South Carolina ponds.
3. Triploid grass carp (White Amur): This fish is a sterile form of the original White Armur. It controls a wide variety of submersed vegetation, but will not control species that grow out of the water like cattails, lilies, alligatorweed, etc. Triploid carp have only been available in South Carolina since 1985, but preliminary results have been very promising. They cost about $8.00 per fish, and are stocked at the rate of 5-20 per acre. They often produce better long-term results for the money than herbicide treatments. These fish can be obtained directly form commercial suppliers and every district fishery office has a list of approved dealers. Since grass carp do not effectively control all aquatic weeds, you are urged to have your pond inspected by a qualified pond specialist prior to stocking these expensive fish, so that the weeds can be correctly identified and stocking recommendations can be provided.

Note: Non sterile forms of the white amur are illegal to import or possess in South Carolina. Fish must be purchased from an approved dealer.

Approved aquatic herbicides round out the list of tools for weed control. Properly used, they can provide safe and effective vegetation control. In South Carolina, experience is showing that a combination of

herbicide(s) and triploid grass carp is often the most effective and cost-effective method for long-term nuisance vegetation control. If you have an aquatic weed problem that has not responded to preventive measures take the following actions:

1. Accurately identify the problem weed(s), so that the proper herbicide can be selected. Many herbicides are very selective in their action. It is neither economical nor environmentally responsible to use a herbicide that is not effective.
2. Obtain professional advice concerning weed treatment. This advice is free of charge from several state and federal agencies.
3. Never use unapproved chemicals in your pond. They could be dangerous to fish, mammals, turtles, birds, bankside vegetation, etc. They could possibly cause downstream damage for which you could be held liable. Always read the entire label before you use any herbicide and follow label directions carefully. If there is any doubt in your mind about the meaning of the label directions, contact an expert – don't guess.

fish mortality

Most fish mortality occurs in South Carolina as a result of dissolved oxygen (D.O.) depletion, pesticide toxicity, or parasite and disease damages.

Oxygen depletion is by far the most common cause of fish kills. They can be largely prevented by good management practices, but will occasionally occur in even the best managed ponds. They occur mostly in the spring and summer as a result of the unique conditions that exist during that time. Some of the most common causes of D.O. depletion are:

1. Overturns - Remember that ponds stratify during the summer, and that the lower layer of water contains little or no D.O. A high wind can physically mix the water in the pond, or overturn it. This mixes the small amount of oxygenated water in the upper layer with the large volume of unoxygenated water on

the bottom, resulting in a mix that has too little D.O. in it for fish to survive. A heavy, cool rain can have the same effect. If the previous few days have had little sunshine, the effect will be worse, since oxygen levels in the upper layer are likely to be lower initially.

2. Overfertilization - Overfertilization can produce excessively dense blooms of phytoplankton. This phytoplankton produces oxygen on sunny days, but very heavy blooms will utilize nearly all of that oxygen during the night, leaving very little for fish respiration.
3. Aquatic plant die-off - Sometimes a heavy phytoplankton bloom or infestations of aquatic weeds in a pond will die off for some reason. As the plants decompose, oxygen is consumed, leaving none for the fish.

symptoms of D.O. depletion

- Fishes gulp at the surface of the water. This is especially noticeable early in the morning when oxygen levels are likely to be lowest.
- Fish might congregate near sources of fresh incoming water.
- Large fish usually die first. If the problem is severe enough, smaller fishes will follow.

treatment

The only effective treatment is to aerate the water, either by the use of mechanical aerators or by exchanging the water in the pond with fresh water.

Aerators may be of several types. Power takeoff devices such as paddlewheels or Crisafulli pumps work well but are expensive and require a tractor as a power source. They are used primarily by commercial fish culturists who have invested heavily in their fish stock.

Spray aerators (those that float on the water's surface) are also effective, but the initial cost is high and an electrical hook-up is required. The best practical method is the use of a gasoline-powered high capacity irrigation pump as shown in Figure 4. The water should be sprayed out over the surface of the water in as fine a spray as possible. Except for very small ponds, several pumps may be necessary to save all of the fish.

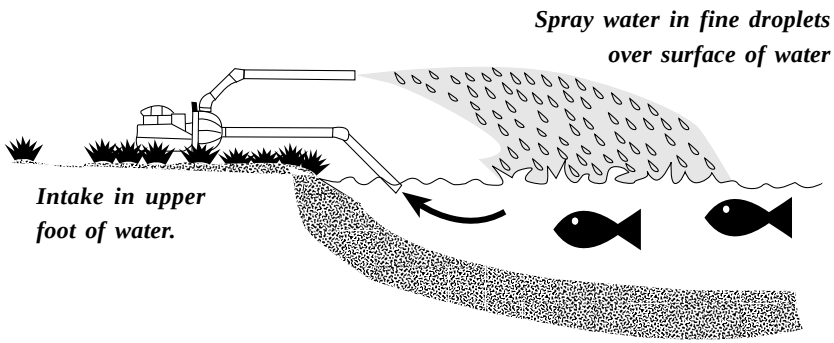

Figure 4 - Using an irrigation pump for aerating pond water.

First aid for D.O. depletions can also include the addition of oxygenated water to the pond from outside sources. If an oxygenated stream is nearby, water can be pumped from it into the pond, even if there is the risk of adding "wild" fishes to your balanced pond. Well water may also be used, provided its oxygen content is known. Often, well water is low or lacking in D.O., in which case it will need to be directed over baffles or broken into fine droplets before entering the pond. The purpose of this is to increase the surface area of the water thereby increasing the rate at which it can absorb oxygen. If possible, deoxygenated water should be pumped out of the pond as fresh water is added.

In general, most oxygen depletion mortalities run their course without treatment of any sort. In some cases, the loss of fish is not heavy enough to justify restocking. Consult a fishery biologist to assist you in making that determination.

pesticide mortality

Fish deaths due to pesticide toxicity are common in intensively farmed areas. Occasionally a heavy rain immediately after pesticide application will wash chemicals off the plants and into an adjacent pond. Careless aerial spraying can also result in pesticide mortality.

Runoff accidents can be prevented by diverting field runoff from your pond, either with a diversion ditch or a berm. Aerial applicators should be encouraged to spray carefully and then only under minimum wind conditions. Once the toxin is in the water, little can be done. Pesticides, if present in sufficient concentrations, will usually affect smaller fishes first, rapidly working its way up to the larger ones. Often, the pond will require renovation after a pesticide kill.

parasites and diseases

Parasites and diseases are common on fishes in warm South Carolina waters. Infestations usually kill just a few fish at a time and generally present no major problem except to intensive commercial operations.

The situation almost always corrects itself within a few weeks, and treatment is seldom practical. The district fishery biologist is able to identify the problem and will advise you of the best course of action.

Any time a pond owner notices dead or distressed fish in his pond, the following steps should be taken:

1. Call a capable pond specialist immediately. Do not wait until Monday or until you have finished painting your house -- do it right away. Once fish have stopped dying, the chances of determining the cause of death drop dramatically. SCDNR District offices are located in Clemson, Rock Hill, Florence, Bonneau, Barnwell, Greenwood and Columbia, all of which deal with fisheries problems. In addition, the Department of Natural Resources Enforcement Division has Conservation Officers in every county who are happy to aid pond owners in obtaining the proper assistance. The Department of Health and Environmental Control has personnel trained in investigating fish kills, and maintains various offices statewide. The Natural Resources Conservation Service is often able to provide guidance in cases of fish

mortality. Their District Conservationists are located in every county of the state.

2. If fish are still in distress, note their behavior. Are they gulping at the surface? Trying to leap out of the water? Swimming in circles? Count the dead fish if possible, keeping a tally of what sizes and species are involved.
3. If pesticides have been applied near the pond within the last two weeks, make a note of what kind (brand name), how applied, etc.
4. Do not consume fish from the pond until the cause of the kill has been determined.

muddy water

Turbidity prevents light penetration and prevents the growth of beneficial phytoplankton. It is usually caused by runoff from unstabilized watersheds such as cropland, road cuts, etc. This can be prevented by good land use practices on the watershed, or by the construction of diversion ditches around the pond. In dug ponds, it is sometimes sufficient to construct a low berm or dike around the pond perimeter to retard unwanted siltation.

If excess turbidity persists, it may be removed by the application of aluminum sulfate (filter alum) at the rate of 50 lb. per acre-foot of water. The alum should be dissolved in water and quickly distributed over the entire pond surface, preferably by spraying. Application should be made during calm, dry weather and the water should be agitated as little as possible during and after application.

If the total alkalinity of the water is below 20 ppm (as is the case with many South Carolina ponds), alum treatment may lower the pH to dangerous levels. Hydrated lime (slaked lime or builder's lime) applied at the same time at the rate of 30 lb. per acre-foot of water will counteract undesireable acid formation. It is important to distribute the recommended amounts of material as evenly as possible for best results.

An alternate method of clearing turbidity that has enjoyed considerable success consists of adding 12 pounds of superphosphate for each 1,000 cubic feet of water. This works out to about 520 pounds of superphosphate for every acre-foot of water. The superphosphate is applied by dumping it slowly from the bow (or stern) of a boat while moving slowly over the pond. It is important to distribute the recommended

amounts of material as evenly as possible for best results. As it clears particulate turbidity, the superphosphate may also produce a heavy plankton bloom; however, the pH shift associated with aluminum sulfate is absent.

Another alternative is to lime ponds as recommended in the section on fertilization, prior to alum treatment. This lime will often precipitate clay turbidity by itself, but if cloudiness persists after liming, alum treatment may be used without danger of ph depression. It is wise to consult a pond specialist if a problem with persistent turbidity exists.

artificial feeds

If a pond is properly managed, supplemental fish feeding is not necessary for good fish growth. Some pond owners enjoy the practice because it allows them to actually see their fish and it also concentrates the fish temporarily for easy hook and line harvest.

A pelleted floating ration is best because the amount of uneaten food can be easily determined. A fingerling catfish sized pellet is recommended because it is more readily eaten by bream. Feed only as much as the fish will consume in 30 minutes because uneaten food will cause water quality problems as it decomposes. If you feed at the same place each day and follow a regular schedule, the fish will quickly learn to anticipate the meal.

In ponds that cannot be fertilized effectively, a regular feeding program can be used to increase production. The pond should be fed every day during the growing season (Water temperature > 60 F). An automatic feeder is a great help and can be set to feed several times a day. Gradually increase feeding rates to 7-10 lbs. per acre per day without accumulating uneaten food. Reaching these feeding rates may take a period of time in infertile ponds.

alligators

Alligator numbers in South Carolina are growing as a result of protection by state and federal statutes. Consequently, it is not unusual for one to take up residence in a fish pond. If this happens, it is generally not necessary to take any action, since alligators are not harmful to fish populations. However, they do occasionally consume birds and small mammals that venture into the water. Therefore, precautions may need to be taken if

TURTLE *trap*

Materials:
A-1"x6"
B-Steel Rod
C-1/2" galvanized wire
D-2"x2"
E-1"x10"
F-1"x10"
G-1"x10"

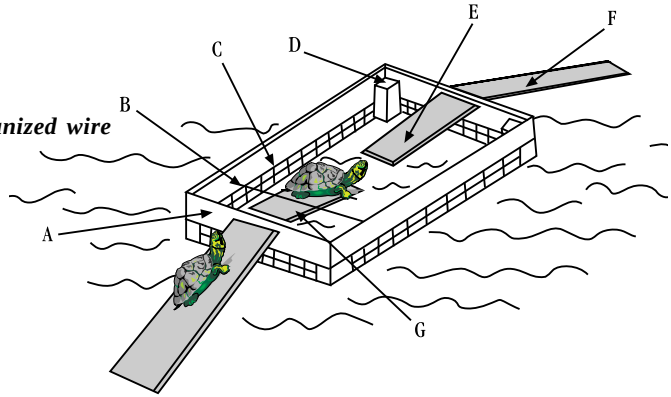

Figure 5: The trap need not be limited by these suggested materials or dimensions. Other similiar designs may be as effective.

Construction: This trap can be built in a variety of sizes, but the most common size is 3'x3'. The trap should be placed so that it is one half submerged with the bottom of the trap resting firmly on the pond bottom. Walkway boards (F) should be placed at 45 degree angles with half of the board submerged. The trip boards (E) are counterbalanced (G) so that they will return to a normal position after the turtle falls into the trap. The galvanized wire should be treated with an asphalt coating to increase the service life of the trap.

This trap utilizes a turtle's desire to sun himself as a means of capture. If the turtles are not removed frequently, they will drown.

The trap should be anchored, or it may float off into deeper waters where it will be less effective or might sink.

domesticated ducks are present, or if family pets such as dogs swim in the pond. A problem is seldom encountered by humans if the gator is left alone and is not given food.

Alligators are protected by law and it is a state and federal offense to injure them. If a problem with an alligator is anticipated, contact the SCDNR alligator project leader at the Dennis Wildlife Center (Phone: 803-825-3387) or a local conservation officer for assistance. He will advise you of the best course of action, which may include removal of the reptile to a more suitable location.

turtles

Turtles eat mostly plant material and animal remains, and are not a problem with fish populations in ponds. However, if numerous enough, they may create a nuisance by taking bait and attacking stringers. Turtle traps (see figure 5.) may be used to reduce their numbers.

snakes

The wet margins of ponds are ideal habitat for water snakes, both poisonous and nonpoisonous. Water-dwelling snakes do eat fish, but too few to be detected by the manager. It is senseless to slaughter snakes as they provide a service by controlling pest populations. Unless the manager is skilled in distinguishing poisonous from nonpoisonous varieties, snakes should be observed and enjoyed from a distance.

beavers & other problem mammals

Beavers, otters, and muskrats may cause problems by interrupting water supplies, destroying vegetation, or by burrowing into to dams or pond banks. Trapping is the best way to reduce mammal populations, but all game laws must be observed. There are open seasons at certain times on otter, beaver, and muskrat, and depredation permits may be obtained during closed seasons with proper justification. The SCDNR has small game and furbearer specialists that are experts in dealing with problem mammals. You are encouraged to take advantage of their experience prior to attempting to take any nuisance mammal.

livestock

Cattle and other livestock having free access to a fish pond may cause damage in several ways. Their wading stirs up sediments and causes muddy water, as well as bank damage. Wading will also hamper fish spawning in the spring and summer by damaging eggs and nests and by frightening fish from their nests.

Pond owners in South Carolina frequently place hog lots adjacent to their fish ponds to allow the hogs access to the water. This practice is fine for swine, but poses a direct threat to pond fishes. Hog lot waste is very high in organic matter and can cause a D.O. depletion if washed into a pond suddenly by a heavy rain. There is also a possible link between animal manure and fish disease.

If stock must be given access to your fish pond, it is a good idea to allow them to use only a small portion of the pond. This can be accomplished by the appropriate use of fencing. Hog lot runoff can be diverted from the pond with berms or diversion ditches.

water birds

Fish are major food items for several water birds such as kingfishers and herons. However, their consumption is so low that there is no danger to pond population balance. Ignore them, or better still, enjoy observing their unique habits.

Ducks, although of little value for weed control, can be a source of great enjoyment to pond owners. Ducks do not harm fish nests or eggs, but enough of them can create quite a mess around pond banks. Many pond managers install wood duck nesting boxes to attract that native South Carolina species.

other game fish species

In general, the only combination of fishes that has consistently produced good fishing ponds in South Carolina is bream and largemouth bass, with channel catfish as an option. For that reason, the addition of other fish species is discouraged.

Crappie do well in large lakes and reservoirs where water levels often fluctuate. In smaller lakes and ponds, their abundance is cyclic or erratic, and they can cause a severe population imbalance. They also compete directly with bass and bream for food.

The addition of catfish to a bass-bream pond is an excellent way to add another dimension to your fishing. Even though it will slightly decrease the overall poundage of bream, you will probably not be able to detect it. Channel catfish may be stocked at the rate of about 50 per acre. It is best to stock them before bass are stocked, because largemouth bass can take a serious toll of catfish fingerlings if the bass are larger. Do not stock bullheads in your pond. They readily reproduce in small impoundments and can ruin population balance in a short period of time. Presently the SCDNR hatcheries are not rearing catfish for pond stocking, but a listing of commercial growers can be obtained through the Fisheries District office nearest you.

Georgia Giants are bream hybrids reputed to have a very high growth rate. They are stocked in much the same manner as bluegills or can be stocked at much higher rates if they are given artificial feeds. They are aggressive and bite well, but must be poisoned out and restocked every three years. Their initial purchase

price is also relatively high. Most pond owners who have tried the hybrids in South Carolina report that the fish falls considerably short of expectations. The SCDNR does not encourage their use.

glossary

ACRE-FOOT - An acre of water a foot deep. It contains 43,560 cubic feet of water. To calculate acre-feet, multiply the number of surface acres by the average depth in feet.

ALKALINITY - The amount of bases (mostly carbonate and bicarbonate ions) in the water. Moderate to high alkalinity in a pond helps to prevent rapid pH changes and also insures an adequate supply of available carbon for phytoplankton growth. South Carolina ponds usually have low alkalinities.

ALUMINUM SULFATE - A compound that causes suspended clay particles (turbidity) to coagulate and precipitate from the water in a few hours if applied properly. It is also called filter alum.

BERM - A low dike or retaining well.

BLOOM - The green color produced in a pond when it has been fertilized. It is composed of millions of microscopic plants floating free in the water, and provides the first step in a food chain that leads to fat, health fish.

CUBÉ - Another name for rotenone.

DHEC - Department of Health and Environmental Control.

DISSOLVED OXYGEN - "D.O." That oxygen dissolved in water. It is the form of oxygen that fishes require for respiration.

HARDNESS - The total amount of metal ions (mostly calcium and magnesium) dissolved in water. Ponds with a hardness below 20 ppm are difficult to fertilize economically. Hardness may be raised in a pond by liming. Alkalinity and hardness in South Carolina ponds are usually near the same magnitude.

HUMIC ACIDS - Those acids produced by the deterioration of plant materials. They cause many coastal plain streams and ponds to darkly stain (coffee or tea water) and to have a low pH.

MORTALITY - Death.

OVERTURN - An event wherein the upper, oxygenated layer of water in a pond is displaced, either by wind action or by a heavy, cool rain. This causes ponds waters to mix, frequently creating overall conditions so low in D.O. that fish cannot survive.

OXIDATION - The process by which any material combines with oxygen. In ponds, when aquatic plants die they rot and oxidize, taking D.O. from the water in the process.

PESTICIDE - A chemical substance used to control pests, either plant or animal varieties. Herbicides are specifically for plant pests, insecticides for insects, etc.

pH - A measure of the acidity of the water.

PHYTOPLANKTON - Microscopic plants that form the “bloom: in ponds. They are usually green, but may occasionally appear brownish or bluish.

PPM - Parts per million. To obtain for example, a salt solution of 1 ppm in an acre-foot (43,560 cubic feet, or, 325,830 gallons) of water, 2.7 lbs. of salt would have to be added.

RETENTION TIME - The time it takes for a pond to completely exchange all of its water (outgoing for incoming). Retention times may vary, depending usually on the volume of incoming water. If the retention time of the pond is less than about 3 weeks, fertilizer does not have a chance to work properly before it is flushed from the pond.

ROTENONE - A substance used to kill fish. It causes them to be unable to use the oxygen available to them. Rotenone is harmful to any animal that possesses gills. It is a Restricted-Use Herbicide.

SCDNR - South Carolina Department of Natural Resources.

STRATIFICATION - The phenomenon in which water “layers” in a pond with respect to temperature. The warmer, lighter water forms a high quality upper layer and the cooler, heavier water forms a low-quality layer on the bottom. The bottom layer usually has a much larger volume than the upper layer.

TURBIDITY - Muddy water. It is usually caused by suspended clay particles.

agencies to contact concerning fish ponds

Natural Resources Conservation Services has field offices in every county in the state. For phone numbers, look in your local phone book under Government offices, U.S. Agriculture Department.

Department of Health and Enivronmental Control (DHEC) is located at 2600 Bull Street, Columbia, SC 29201. For fish kill assistance, call the EMERGENCY RESPONSE NUMBER: 1-803-253-6488.

South Carolina Department of Natural Resources Offices:

Fisheries District 1 Office
P.O. Box 1806
Clemson, SC 29633
(864) 654-6346
Greenville, Oconee, Pickens, and Spartanburg

Fisheries District 2 Office
P.O. Box 1040
Abbeville, SC 29620
(864) 223-2008
Anderson, Abbeville, Edgefield and McCormick

Fisheries District 3 Office
108 Highland Drive
Greenwood, SC 29649
(864) 223-1307
Greenwood, Laurens, Newberry and Saluda

Fisheries District 4 Office
P.O. Box 4496
4037 Indian Hook Road
Rock Hill, SC 29730
(803) 366-7024
Cherokee, Chester, Union, Fairfield, Lancaster & York

Fisheries District 5 Office
P.O. Drawer 190
Bonneau, SC 29431
(803) 825-3387
Clarendon, Williamsburg, Georgetown, Berkeley, Charleston and Dorchester

Fisheries District 6 Office
1324 Dunbarton Blvd.
Barnwell, SC 29812
(803) 259-5474
Aiken, Barnwell, Bamberg, Orangeburg, Allendale, Hampton, Jasper, Colleton, and Beaufort

Fisheries District 7 Office
2007 Pisgah Road
Florence, SC 29501
(803) 661-4767
Chesterfield, Darlington, Dillon, Florence, Horry, Marion, and Marlboro

Fisheries District 8 Office
P.O. Box 167
Columbia, SC 29202
(803) 955-0462
Lexington, Richland, Calhoun, Lee, Sumter and Kershaw Counties

If you have urgent business such as a fish kill and cannot contact a fishery office near you, call the Law Enforcement “Hotline” number: 1-800-922-5431. The operator should be able to contact the appropriate person. Please do not call the “HOTLINE” number for routine requests.